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ON-BOARD POWER GENERATION SYSTEM FOR A GUIDED PROJECTILE

DEDICATORY CLAUSE

[0001] The invention described herein may be manufactured, used and licensed by or for the Government for governmental purposes without the payment to us of any royalties thereon.

BACKGROUND OF THE INVENTION

[0002] The U.S. military forces currently are facing a variety of low-cost air-borne threats that include unguided rockets, mortars, unmanned aerial vehicles and cruise missiles. The traditional response to these threats has been to engage them with sophisticated guided missiles. Such guided missile engagements are technically viable but very expensive. A more cost-effective means of countering the low-cost threats would be to use guided medium caliber (20mm-40mm) projectiles.

[0003] Such projectiles can be launched out of guns that are positioned on combat vehicles. Guns possess significant operational advantages over other weapon systems in local air defense and other close engagements, the primary advantage being a significant increase in the number of stowed kills. Hundreds of medium caliber gun rounds can be stored in the same space as ten missiles.

Additionally, bullets carry a substantial cost savings over missile systems, thereby allowing a more liberal use during the battle.

[0004] However, to be effective, guns must have some capabilities that are not normally required by an artillery system: specifically, a very short targeting time, capability against highly agile targets and enhanced precision. Guided smart munitions would provide such capabilities. Further, they would alleviate any targeting errors that may result from launch biases and improve lethality by allowing enhanced aimpoint selection.

[0005] A critical aspect in the development of guided projectiles is the power generation to provide power to the guiding means that will reside inside the projectiles. The power generating means must be lightweight and suitable for incorporation into an environment that has limited space and is subject to significant spin rates and high shock loading.

SUMMARY OF THE INVENTION

[0006] Traditional and thermal batteries are not suitable for use as power sources for guided projectiles due to their size and relatively short shelf life. **On-Board Power Generation System for a Guided Projectile** does away with the need for the battery by utilizing, instead, an electrical generator to produce power and a wind-driven turbine to drive the generator. In this way, a small portion of the projectile's kinetic energy is converted into electrical energy. The power output of the generator is, then, coupled to the guiding means. The projectile is appropriately configured to accommodate therein the power generation system and the air inlets and exhaust ports necessary to enable the system to function.

DESCRIPTION OF THE DRAWING

[0007] Figure 1 shows an exterior view of a typical guided projectile utilizing the **On-Board Power Generation System for a Guided Projectile**.

[0008] Figure 2 is a diagram of the preferred embodiment of the **On-Board Power Generation System for a Guided Projectile**.

[0009] Figure 3 shows details of the turbine section of the system.

[0010] Figure 4 is an exterior view of a guided projectile with an alternate embodiment of the **On-Board Power Generation System for a Guided Projectile**.

[0011] Figure 5 details the turbine section of the alternate embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0012] Referring now to the drawing wherein like numbers represent like parts in each of the several figures, arrowheads indicate signal travel and the direction of the flight of guided projectile 100 is to the right, the configuration and operation of the **On-Board Power Generation System for a Guided Projectile** is explained in detail.

[0013] As shown in Figure 1, the preferred embodiment has an air inlet 109 at forward end 107 and a plurality of exhaust ports 105 on housing 103. The projectile further has longitudinal axis 101 about which it rotates in a given direction during its flight toward a selected target. In addition, the projectile contains a guiding means such as radio frequency electronics 215 and flight computer 217 to guide it for a greater accuracy in impacting the target.

[0014] The **On-Board Power Generation System** to provide the necessary power to the guiding means comprises cylindrical hole 201 drilled from air inlet 109 through the middle of the projectile to exhaust ports 105, turbine 205 mounted at the end of the cylindrical hole near the exhaust ports and electrical generator 209 coupled to the turbine. As the air stream passes over the

turbine, the vanes of the turbine turn in a direction that is opposite of the rotation direction of the projectile. The relative positions of the vanes to each other at any given point in time during their rotation is indicated by the slanted lines, as shown in Figures 3 and 5. The turbine whose vanes rotate thusly drives the electrical generator which, in response, produces voltage output. The output of the generator is input to capacitor 213 that performs low-pass filtering to smooth the output and stores the output for use in short-term, high-energy demand situations such as firing thrusters 219 or operating other control surfaces (not shown). Additionally, voltage regulator 211 is placed between the capacitor and the guiding means to stabilize the voltage further.

[0015] Electrical generator 209 is coupled to turbine 205 by shaft 207. As illustrated in Figure 3, the turbine converts the energy of the fluid stream into kinetic energy by use of the channeled air stream against the turbine vanes. The air stream enters through inlet 109, passes through the turbine and exits radially from the projectile through exhaust ports 105. The rotating motion of the turbine vanes drives the shaft, thus driving the generator. The spacing between the vanes of the turbine is determined by the power generation requirement, which, in turn, is determined by the speed of the projectile.

[0016] An alternate embodiment, illustrated in Figures 4 and 5, places an exhaust port 405 at aft end 401 and multiple air inlets 403 on the housing. Turbine 205 is placed toward the rear of the projectile and the air inlets are positioned between the turbine and electrical generator 209 as shown in Figure 5. This embodiment reduces the projectile drag, because the incoming air stream passes through the turbine further down the body of the projectile, but is less energetic than the preferred embodiment and, consequently may require a higher air stream velocity or a larger turbine.

[0017] Although particular embodiments and forms of this invention have been illustrated, it is apparent that various modifications and other embodiments of the invention may be made by those skilled in the art without departing from

the scope and spirit of the foregoing disclosure. One modification is to add high-speed bearings 301 adjacent to shaft 207 as shown in Figure 3 to render stability to the shaft. Accordingly, the scope of the invention should be limited only by the claims appended hereto.